The retyped pages 16, 17, and 39 of the marked-up version of the substitute specification.

distributions of the fluid respectively over the surface of the ith solid element; and $\vec{F}_i^{(e)}$ is the total external force acting on the ith solid element.

Further, the momentum equation for the total fluid can be written in the integral form as follows

$$\frac{\partial}{\partial t}\oiiint_{v(t)}\rho(\vec{v}+\vec{V})dv+\oiint_{S(t)}(\rho\vec{V}\,d\vec{S})\vec{V}=-\oiint_{S(t)}pd\vec{S}-\oiint_{S(t)}\vec{\tau}dS+\oiiint_{v(t)}\rho\vec{f}dv \qquad (502)$$

where $v(t)$ and S(t) are the volume and boundary surface of the fluid respectively. They are time functions due to motion of the internal solid elements. The first term in the left side is the time rate of change of the momentum of the fluid due to motion of the fluid with the velocity $\vec{v}_0=\vec{v}+\vec{V}$, in which $\vec{v}$ is the velocity of the whole solid-fluid body or the velocity of the solid chamber, $\vec{v}=\vec{v}_1$, and $\vec{V}$ is the velocity of the fluid particles relative to the solid chamber. The second term in the left side is the flow of momentum out of the space containing the fluid. The first term in the right side of the equation is the complete pressure force over the entire surface of the fluid. The second term in the right side is the shearing force, i.e. complete reaction of all the solid elements against the shear stress distribution of the fluid over them. The third term is the total body force exerted on the fluid.

The first term in the left side can be written as

$$\frac{\partial}{\partial t}\oiiint_{v(t)}\rho(\vec{v}+\vec{V})dv=\frac{d}{dt}\vec{p}_0+\frac{\partial}{\partial t}\oiiint_{v(t)}\rho\vec{V}dv \qquad (503)$$

where the first term in the right side of Eq. (503) is the time rate of change of the momentum of the whole fluid as a lump in free space.

The surface of the fluid is confined to the surfaces of the solid elements. Therefore, the second term in the left side of Eq. (502) vanishes

$$\oiint_{S(t)}(\rho\vec{V}.d\vec{S})\vec{V}=0 \qquad (504)$$

Then summing the momentum Eq. (501) for all the solid elements with Eq. (502) for the fluid gives

$$\sum_{i=0}^{N}\frac{d}{dt}\vec{p}_i+\frac{\partial}{\partial t}\oiiint_{v(t)}\rho\vec{V}dv=\sum_{\substack{i,j=1\\ i\neq j}}^{N}\vec{F}_{ij}+\sum_{i=1}^{N}\vec{F}_i^{(p)}+\sum_{i=1}^{N}\vec{F}_i^{(\tau)}-\oiint_{S(t)}pd\vec{S}-\oiint_{S(t)}\vec{\tau}dS+$$

$$+\oiiint_{v(t)}\rho\vec{f}dv+\sum_{i=1}^{N}\vec{F}_i^{(e)} \qquad (505)$$

*Applying Newton□s third law for interaction between the solid elements and their interaction with the fluid yields*

$$\sum_{\substack{i,j=1\\ i\neq j}}^{N}\vec{F}_{ij}=0 \qquad (506)$$

$$\sum_{i=1}^{N}\vec{F}_i^{(p)}-\oiint_{S(t)}pd\vec{S}=0 \qquad (507)$$

*and*

$$\sum_{i=1}^{N}\vec{F}_i^{(\tau)}-\oiint_{S(t)}\vec{\tau}dS=0 \qquad (508)$$

*Thus the momentum equation of the solid-fluid body must be written*

$$\sum_{i=0}^{N}\frac{d}{dt}\vec{p}_i=-\frac{\partial}{\partial t}\oiiint_{v(t)}\rho\vec{V}dv+\oiiint_{v(t)}\rho\vec{f}dv+\sum_{i=1}^{N}\vec{F}_i^{(e)} \qquad (509)$$

*In Eq. (509) the term in the left side, which is the time rate of change of the total of the momentums of all the elements of the solid-fluid body in free space, must be equal to the total force acting on the solid-fluid body to accelerate it in free space; the second and third terms in the right side represent the total of external forces acting on the solid-fluid body. Therefore, the first term in the right side must be a force that the solid-fluid body acts on itself due to unsteady flow fluctuations of the fluid. We denote this force by* $\vec{F}_s$, *i.e.*

$$\vec{F}_s=-\frac{\partial}{\partial t}\oiiint_{v(t)}\rho\vec{V}dv \qquad (510)$$

*Substituting Eq. (501) for the time rate of change of the momentum of each solid element in Eq. (509) gives*

*where $p_1$ is the pressure of the gas on the floor of generator chamber **172**. If $\rho_0$ is the density of the gas at rest, then due to the conservation of mass we have*

$$\rho_0 Al = \int_0^l A\rho(z)dz = \int_0^l \frac{Ap_1}{RT} e^{-\frac{a}{RT}z} dz = -\frac{Ap_1}{a}(e^{-\frac{a}{RT}l} - 1) \tag{575}$$

*where $l$ is the average height of generator chamber **172**. From Eq. (575) we have*

$$p_1 = -\frac{l\rho_0 a}{(e^{-\frac{a}{RT}l} - 1)} \tag{576}$$

*Substituting formula (576) for $p_1$ in Eq. (574) yields*

$$p(z) = \frac{l\rho_0 a}{(e^{-\frac{a}{RT}l} - 1)} e^{-\frac{a}{RT}z} \tag{577}$$

*From Eq. (577) we obtain the difference in pressure between the ceiling and floor*

$$p_2 - p_1 = -l\rho_0 a \tag{578}$$

*Then the force due to the pressure distributions over the ceiling and floor is*

$$\vec{F}^{(p_1)} + \vec{F}^{(p_2)} = -\hat{k}Al\rho_0 a = -m_0\vec{a} \tag{579}$$

*It is obvious that the total force due to the pressure and shear stress distributions over the walls of mobile object **168** vanishes. The force due to the pressure and shear stress distributions over the surfaces of blades of rotor **170** is its aerodynamic lift, $\vec{L}_R$. Then according to Eq. (513) the self-action force of mobile object **168** is*

$$\vec{F}_s = m_0\vec{a} + \vec{F}^{(p_1)} + \vec{F}^{(p_2)} + \vec{L}_R - m_0\vec{f} = \vec{L}_R - m_0\vec{f} \tag{580}$$

*The last term in the right side of Eq. (515) vanishes, since the center of mass of rotor **170** is at rest in relation to generator chamber **172**. Therefore, putting the corresponding forces into Eq. (515) gives*

$$M\vec{a} = \vec{F}^{(p_1)} + \vec{F}^{(p_2)} + \vec{L}_R + \vec{F}^{(e)} = -m_0\vec{a} + \vec{L}_R + \vec{F}^{(e)} \tag{581}$$

*where $\vec{F}^{(e)}$ is the total external force acting on all the solid elements of the mobile object.*

*From Eq. (581) we obtain the acceleration of mobile object **168***

$$\vec{a} = \frac{\vec{L}_R + \vec{F}^{(e)}}{m_0 + M} \tag{582}$$